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Policy measures in the deleveraging process: A macroprudential evaluation

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Abstract

This paper evaluates post-crisis effects of deleveraging policy in Slovenia. Reductions in banks' credits to nonfinancial sectors were driven by increased collateralization, credit rationing, and a neglect of cash flow performance of banking clients. These jeopardized the normal deleveraging of companies with positive cash flows, and rolling over credits, which stifled economic growth. Erroneous sequencing, timing, and calibration of measures steering the deleveraging process generated these processes. Optimal deleveraging process demands that the Central Bank also focus on the stability of the financial system. This task should be a constitutional part of the third macro policy pillar, namely macroprudential policy.

JEL classification: E61; G18; G21

Keywords: Balance sheet crisis; Collateral; Deleveraging; Cash flow; Banks; Illiquidity

1. Introduction

In many developed countries much focus has been placed on fiscal consolidation policies due to excessive budget deficits resulting from the eruption of the crisis. However, the latest study conducted by Blanchard and Leigh (2013) shows that the introduction of fiscal consolidations

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resulted in even lower economic growth than foreseen. They explain this fact by stating that "actual fiscal multipliers have been larger than forecasters assumed" (p. 19). This implicitly calls into question the effectiveness of the austerity programs imposed and requires further thought in relation to the optimal mix of economic policies in the post-crisis period. Along the same procyclical argument, the reasonableness of straining microprudential policy implemented almost systematically by the EU banking regulators in the post-crisis period could be called into question. Its effects could be, like those of fiscal austerity measures, only procyclical and, because of its prolonging credit crunch effects, harmful not only for recovery but also for macro financial stability. Hence, it could not be unexpected that a new (third) pillar of macroeconomic policy, macroprudential policy, has been emanating from rethinking macroeconomic policy after the crisis, which would have financial resilience as well as output objectives.[1]

The above mentioned is particularly topical in countries that were affected by the so-called balance sheet crisis. Slovenia is a good example of such an affected country. The existence of the mechanism, which (through financial accelerator) endogenously amplified and propagated the process of companies' debt accumulation triggered by external funds inflow in the pre-crisis period in Slovenia, is already well documented.[2] The sudden stop of financial inflows and the collapse of external real demand reverted booming growth to a spiraling downturn in the post-crisis period; from seven percent growth in the pre-crisis year of 2007, the economy faced more than an eight percent fall in growth in 2009. This was followed by near stagnation in the 2010–2012 period.

In this paper we investigate channels through which a lack of appropriate macroprudential policy aggravated economic performances. Cash flow migration and illiquidity contagion of companies from different sectors of the economy and from different sized groups are studied to detect the main factors and policy drawbacks influencing economic performance in the post-crisis period.

We built our research on Miller and Stiglitz (2010) and Krishnamurthy (2010) theoretical models of illiquidity provision after the bubbles collapsed.[3] As asset prices fall, and thus corresponding items in balance sheets fall, firms would not only have problems in repaying debt service, but would also be forced to accelerate repaying debt (deleveraging). Fire sales would be the only way out of the liquidity squeeze. But, fire sales add to the downward pressure on asset prices (nominal value of collateral), which would accelerate deleveraging even more, and highly leveraged borrowers would become insolvent very easily.

To study the deleveraging process after the crisis eruption (financial inflows "sudden stop") in the economy, we added two additional elements to these theoretical models: intercompany credit (debt) and external agent (policy makers – banking regulator) intervention in steering the deleveraging process. If the model also includes companies that produce raw materials, intercompany credit (debt) is an additional type of (debt) financing that amplifies the model boom and bust phase performances (asset prices, volume of credit) of companies (especially small businesses). The opportunity cost (economic activity, employment, loss of net worth) of deleveraging could, therefore, depend on the sequencing of debt redemption. The main reason for this is different repudiation risk protection; for banks (deep pocket investors in the Miller–Stiglitz model) it is credit collateral and the threat of raw material non-supply for intercompany debt (forced credits). The external agent (policy maker) could steer the deleveraging process if able to influence liquidity supply and/or size of repudiation risk protection measures. Its interventions could considerably

[1] See Blanchard et al. (2013) and Haldane (2013).

[2] See Bole et al. (2012).

[3] On earlier version of these models, see also Minsky (1986), Kiyotaki and Moore (1997).

affect the deleveraging process and its opportunity costs by modifying capital requirements, changing necessary collateral, modifying access to the wholesale market of loanable funds, etc.

By investigating a complete database of firms in the manufacturing, service, and construction sectors in the Slovenian economy in the period 2007–2012, we found that procyclical interventions of the banking regulator in Slovenia and corresponding responses by banks resulted in a prolonged (after crisis) credit crunch period. The regulator was pushing banks in across the board intensive deleveraging, taking into account neither a company's performance (e.g. cash flow dynamics) nor a company's structure of (financial versus intercompany) debt. Such a procyclical approach has had a disastrous effect on the Slovenian economy.

To manage the deleveraging process optimally, the regulators would have to choose appropriate timing (time trajectory) of policy interventions, correct sequencing of deleveraging different kinds of debt, and, finally, the appropriate calibration of policy interventions in the process of deleveraging. Results of the study show that, when appropriately designed, all three policy segments could result in a more efficient, macroprudential management of the economy, which would significantly mitigate the opportunity costs of deleveraging (drop in economic activity, fall in employment, loss in net worth).

The paper proceeds as follows. The next section briefly describes the Slovenian policy framework in the pre- and post-crisis periods. The third section shows the credit coverage and rationing for the observed boom-bust period. In the fourth section, an overview of the analyzed segments of companies is given and corresponding performance is documented. In the fifth and sixth sections, central model based evidence is given of the factors driving cash flow migration and the illiquidity contagion mechanism. The last section concludes.

2. Slovenian pre- and post-crisis policy episodes

The pre-crisis period in Slovenia coincided with the country entering the EU and the European Exchange Rate Mechanism 2 (ERMII) mechanism, and later also the European monetary union. In the period of booming world economy, Slovenia implemented nominal landing into ERMII and the euro area almost in a monetary policy vacuum, with falling nominal interest rates, falling sovereign risk premium, and stable exchange rates. The fiscal policy stance was formally neutral, as it ran negligible deficits. Still, the fiscal policy was far too complacent for the economy, which has no control over the monetary policy.[4] Although the standard market institutions of a developed economy, including the system of (banking, capital market and market structure) regulations, were already implemented by entering the EU, they were not enough to prevent disastrous consequences of complacent fiscal policy and far too lax monetary policy. The fast and complete freeing of (foreign) financial flows to accelerate the landing process of the real economy (implemented mainly through the final phase of privatization and acquisitions) was the cliché of the day.

It is the financial accelerator mechanism that endogenously drove the amplification and propagation of the process of a company's debt accumulation, which was triggered by external shock of the financial inflow flood. The financial accelerator was a crucial segment of the debt amplification and propagation mechanism, and expected discounted capital returns were the main determinant of its power. Because the stock market had been accelerating through the whole boom period and the real property market peaked just before the global crisis erupted, expected discounted capital

[4] See, for example, Bole (2006), Bole and MacKellar (2009).

returns had been increasing the power of the financial accelerator and galloping asset prices (real estate and stock) and the size of collateral (and therefore accessible size of loanable funds) in the whole boom period, without interruption (Bole, Prašnikar, & Trobec, 2012).

This period was marked by free access of banks (and other economic units) to external resources of loanable funds, thus having the role of financial "deep pocket" investors described by the Miller–Stiglitz model. Competition among new banks entering the market to carve out high enough market share[5] further fueled the supply of credit. The collateralization of credits was low, and available collateral was abundant because of rapidly increasing asset prices. Real estate was the usual collateral for financing fixed capital investments and portfolio real estate investments. Inventories were used as collateral in financing working capital, while companies' (targets') shares were used to collateralize credits for financial and acquisition investments (Bole et al., 2012).

When the global crisis emerged, the endogenous processes were interrupted by exogenous shocks. Uncertainty on the international financial market triggered a credit crunch on the wholesale market of loanable funds. Because of that, banks in Slovenia were only partly able to refinance their foreign credits and had to curtail the supply of credits to their clients on the domestic retail credit market. Already in 2009, the Slovenian government alleviated the liquidity squeeze of banks (credit crunch on the wholesale market of loanable funds) by launching guarantees to banks to enable them access to foreign markets. Ample intervention by the European Central Bank (ECB) (through a supply of longer-term instruments) further mitigated the liquidity squeeze of banks.[6]

However, alleviation of the credit crunch on the wholesale loanable markets did not neutralize the credit crunch on the retail market, and several factors prolonged the period of the retail credit crunch. First, a drastic drop in demand on foreign and domestic markets increased uncertainty about future economic development, which reduced the information capital of banks (that is, their capability of evaluating the future solvency of their client companies). To offset the reduction in information capital, banks began to increase the necessary collateral coverage of their credits. Even more, banks actually switched their credit policies from a "mark-to-market" approach to a "mark-to-risk" approach. Banks not only began to increase the necessary credit collateral coverage, but also considerably enhanced credit rationing (of appropriately collateralized credit). Both the increase in collateral and credit rationing stopped not only new credits, but also considerably shed automatic credit renewals.

Secondly, the severe credit cut and drop in demand affected the real estate market and construction sector the most. Because both sectors had been booming before the crisis eruption, the collapse in demand pushed real estate prices considerably downward. By the beginning of 2013, prices had dropped in cumulative terms by approximately 18% (in the first four quarters after the crisis eruption by 12%).[7] The fall of real estate prices further decreased the size (value) of companies' collateral and, therefore, increased their credit squeeze.

Finally, the process of increasing credit collateralization and rationing as well as accelerated deleveraging was facilitated also by the banking regulator's supervision measures. After the first quarter of 2010, the Central Bank launched a process of accelerated implementation of stricter capital requirements (Basel III) by: changing (increasing) minimum capital adequacy ratios in very short periods of several months; insisting on mark-to-market valuations of banking assets, even though transactions on the capital market for most companies were negligible or

[5] Foreign banks were entering the market with more favorable credit terms to take over the market share of existing banks, which followed the trend of loosening credit terms (Feldin, Košak, Prašnikar, Raškovič, and Žabkar, 2009).

[6] See, for example, Bole (2009).

[7] See, SORS (2013).

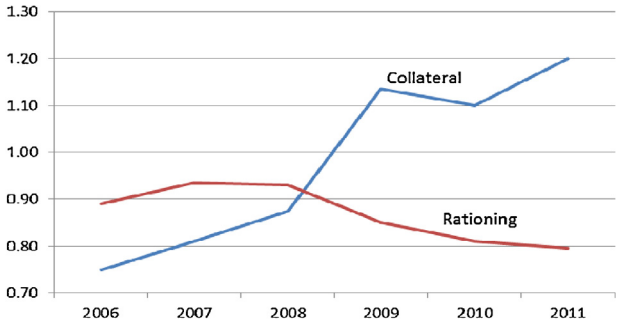

Fig. 1. Collateral coverage and rationing.
Note: Collateral coverage is defined as collateral per unit of credit; rationing is defined as a share of approved credit in total (appropriately collateralized but not saturated) credit volume demanded.
Source: Survey of companies with over 100 employees, AJPES (2012); own calculations.

even non-existent, after the collapse of the stock exchange to less than one-third of its pre-crisis capitalization; increasing upfront capital requirements (marginal capital requirements) for new credits; and increasing second pillar capital requirements (in several banks second pillar attained over 30% of capital requirements), etc. These all came on top of already stricter national supervision standards.[8]

Because of a very short supply of new capital for bank recapitalization,[9] banks were not able to timely fulfill banking regulator requirements. Therefore, banks at first started to restructure their portfolio of assets in favor of claims against the government (its bonds and short-term credits) or in favor of clients with higher available collateral[10] because those claims "consume" less capital. Next, they began to simply squeeze balance sheets through selling assets and cutting credits.

Such procyclical interventions of the banking regulator and corresponding responses of banks resulted in a prolonged (after crisis) credit crunch period, financial disintermediation (spreading of forced intercompany credit), suboptimal sequencing and timing of deleveraging, as well as harmful structural effects. All four effects are documented in the following sections.

3. The evidence on collateral coverage and rationing

Increasing of the credit supply tightness is illustrated in Figs. 1 and 2. In the first figure, credit coverage and rationing for the observed boom–bust period (2006–2011) is illustrated. The data set was extracted from the 2011/2012 survey that was conducted on the largest Slovenian companies in the manufacturing and services industries (companies with over 100 employees). The data was

[8] To illustrate, it is worth to mention that in Slovenia the Internal ratings-based approach (IRB, model approach of capital adequacy evaluation) is used in less than 8% of the banking system; and that Non-performing loan (NPL) determination is client and not claim based, as is normal in EU countries; see, for example, European Banking Coordination Vienna Initiative (2012).

[9] In that time (after 2010), the best banks in the EU were able to get capital at a price of less than one-third of book value. The European banking regulator (EBA) launched a similar process of accelerated increase of bank capital requirements at the end of 2011. That is a year and a half later than the banking regulator in Slovenia.

[10] ECB offer of (cheap) long-term refinancing operations (LTRO) facility further enhanced this process.

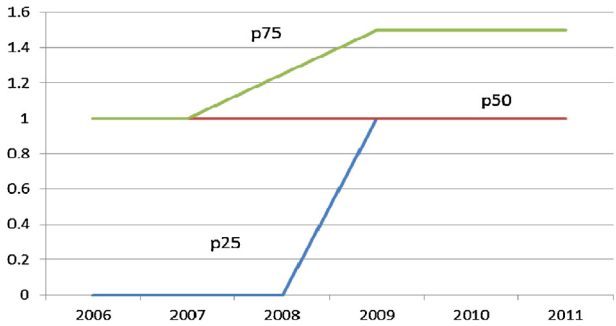

Fig. 2. Distribution of collateral coverage.
Note: Quartiles of companies for collateral coverage distribution.
Source: Survey of companies with over 100 employees, AJPES (2012); own calculations.

collected for 200 manufacturing companies and 141 services companies.[11] The presented figures roughly correspond to similar figures on credit supply in Slovenia from other sources.[12]

Fig. 1 documents that collateral coverage accelerated its growth after 2006, and especially after the financial crisis eruption. In the period 2008–2011, the average collateral coverage increased from around 0.8 to 1.2. The credit squeeze was not only implemented through an increase in collateral coverage, but also through direct credit rationing, which increased in the same period 2008–2011 by almost 15 percentage points.[13] The considerable increases in collateral coverage and credit rationing resulted in a drastic drop in credit growth and, therefore, a drastic squeeze of the companies' liquidity. Consequentially, this resulted in a prolonged deterioration of economic activity after the crisis erupted.[14]

Fig. 2 illustrates the dynamics of the collateral coverage distribution in the 2006–2011 period. In the boom years the distribution of collateral coverage was strongly asymmetric to small values. In 2007, a significant part of companies had very low or even negligible collateral coverage, while the median collateral coverage was already 1. It only took two years for the lower quartile of collateral coverage to increase from practically 0–1. Immediately after the crisis erupted, collateral coverage increased mainly for companies below the median collateral coverage.

4. Analyzed segments of companies – performance and structure

To document the possible size and sector specific effects of the policy-induced (or at least neglected) amplification of the credit crunch, we analyze the cash flow and illiquidity of companies from manufacturing, service, and construction sectors. The first analyzed segment includes all companies with economic activities in section C of NACE Rev. 2. The service sector consists of

[11] These are all companies with more than 100 employees in both sectors.

[12] The figures for 2010, for example, show approximately the same under-supply of credit as the figures from the survey prepared by the EC (http://ec.europa.eu/economy_finance/db_indicators/surveys/time_series/index_en.htm) and figures for collateral coverage available from the Bank of Slovenia. See, for example, BS (2011).

[13] The share of non-rationed credits fell from 0.94 to 0.79.

[14] The growth of credit to the business sector dropped from 29% in June 2008 to 18% in December 2008, 1% in December 2009, 0% in December 2010, and −3.5% in December 2011. See, for example, Bole (2009) and Bole et al. (2012).

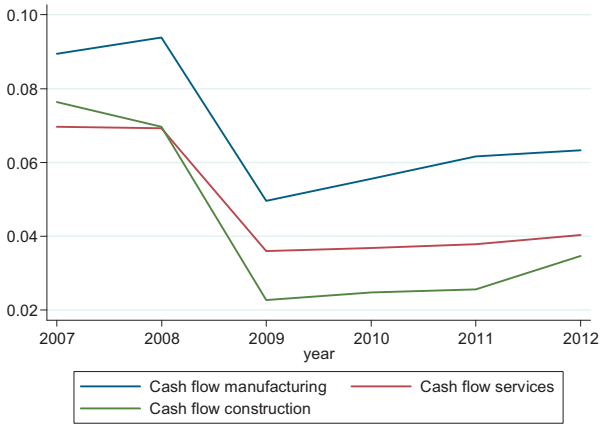

Fig. 3. Cash flow per unit of balance sheet; sectors of companies (median).
Source: AJPES (2012); own calculations.

companies defined by sections G, H, I, L68, N79,[15] D, E, and J[16] and the third analyzed segment of companies (construction) comprises section F of NACE Rev. 2.[17]

In Table 1 an overview of the basic financial performance variables of the analyzed segments of companies in the 2007–2012 period is given. Financial debt, short-term operating receivables and liabilities, "potential" collateral (assets admissible for collateralization of credits), and cash flow from current business are given as percentages of total balance sheets. Figures are given for the manufacturing and services sectors and the construction sector for three quartiles of companies' distribution; namely, for the first-lower quartile (25 percentile), the median (50 percentile), and the third-upper quartile (75 percentile).

As evidenced from Table 1 and shown in Fig. 3, after a huge drop in 2009, cash flow[18] in the manufacturing sector stabilized in 2010. In the services sector, median companies also succeeded in preventing further deterioration of cash flow by 2010. In the construction sector, improvements in cash flow lagged behind companies from both the manufacturing and services sectors; it had been almost stagnant until 2011, but in 2012, three years after the crisis eruption, it improved significantly. Although cash flow stabilized for median companies in all investigated sectors, the sharp drop in the level of cash flow in 2009 has been neutralizing very slowly. In 2012, the cash flow of median companies in the manufacturing and services sectors was still approximately 60–70%, and construction companies' cash flow was only 40–50% of the size of cash flow prevailing before the crisis.

While median values of cash flow started to improve at least after 2010 in all analyzed sectors, the trajectory of cash flow of lower quartiles of companies has been improving much slower. The

[15] The following activities are included: wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities, real estate activities, travel agency, tour operator reservation service, and related activities.

[16] The following services producing activities are included: electricity, gas, steam and air conditioning supply, water supply, sewerage, waste management and remediation activities, and information and communication.

[17] In illustrating empirical evidence, in principle the whole population of enterprises from analyzed segments is taken into account, while in the model experiments outlier filtering is applied on the whole population. Namely, for every variable, firms falling in the lowest or in the highest halfcentil (0.5%) of whole population are classified as outlying.

[18] Cash flow from current operations.

Table 1
Financial and intercompany debt, cash flow and potential collateral.

	Manufacturing							Services							Construction					
	2007	2008	2009	2010	2011	2012		2007	2008	2009	2010	2011	2012		2007	2008	2009	2010	2011	2012
Financial debt																				
N	6711	6622	6677	6856	6980	7108	N	32650	33522	35114	36382	37818	39216	N	6099	6685	6767	6742	6880	7025
p25	0.000	0.000	0.000	0.000	0.000	0.000	P25	0.000	0.000	0.000	0.000	0.000	0.000	P25	0.000	0.000	0.000	0.000	0.000	0.000
p50	0.110	0.144	0.157	0.154	0.152	0.144	P50	0.046	0.060	0.066	0.066	0.064	0.062	P50	0.005	0.014	0.026	0.032	0.025	0.014
p75	0.339	0.391	0.413	0.417	0.416	0.397	P75	0.341	0.381	0.396	0.401	0.402	0.407	P75	0.243	0.275	0.313	0.328	0.320	0.285
Suppliers – liabilities																				
N	6711	6622	6677	6856	6980	7108	N	32650	33522	35114	36382	37818	39216	N	6099	6685	6767	6742	6880	7025
p25	0.153	0.145	0.138	0.141	0.135	0.128	P25	0.114	0.108	0.104	0.105	0.099	0.092	P25	0.150	0.148	0.147	0.157	0.150	0.118
p50	0.301	0.281	0.268	0.275	0.263	0.258	P50	0.304	0.291	0.285	0.287	0.281	0.272	P50	0.373	0.362	0.362	0.374	0.367	0.346
p75	0.512	0.490	0.478	0.498	0.498	0.497	P75	0.573	0.558	0.558	0.568	0.564	0.563	P75	0.621	0.608	0.649	0.673	0.675	0.651
Buyers – receivables																				
N	6711	6622	6677	6856	6980	7108	N	32650	33522	35114	36382	37818	39216	N	6099	6685	6767	6742	6880	7025
p25	0.131	0.129	0.125	0.125	0.117	0.115	P25	0.066	0.067	0.066	0.064	0.059	0.058	P25	0.118	0.118	0.106	0.112	0.107	0.099
p50	0.267	0.265	0.258	0.264	0.253	0.253	P50	0.234	0.229	0.234	0.235	0.226	0.229	P50	0.353	0.357	0.360	0.361	0.359	0.361
p75	0.458	0.450	0.455	0.465	0.452	0.455	P75	0.475	0.481	0.490	0.494	0.485	0.500	P75	0.619	0.636	0.645	0.653	0.664	0.677
Collateral																				
N	6711	6622	6677	6856	6980	7108	N	32650	33522	35114	36382	37818	39216	N	6099	6685	6767	6742	6880	7025
p25	0.000	0.000	0.000	0.000	0.000	0.000	P25	0.000	0.000	0.000	0.000	0.000	0.000	P25	0.000	0.000	0.000	0.000	0.000	0.000
p50	0.116	0.136	0.129	0.112	0.110	0.103	P50	0.000	0.000	0.000	0.000	0.000	0.000	P50	0.000	0.000	0.000	0.000	0.000	0.000
p75	0.416	0.439	0.447	0.432	0.439	0.436	P75	0.239	0.223	0.221	0.211	0.197	0.192	P75	0.124	0.092	0.103	0.116	0.110	0.090
Cash flow																				
N	6240	6176	6258	6311	6490	6593	N	29379	30019	31902	33022	34177	35451	N	4910	5404	5739	5767	5837	5848
p25	0.028	0.029	−0.015	−0.004	0.004	0.007	P25	0.007	0.002	−0.026	−0.026	−0.023	−0.022	P25	0.015	0.009	−0.047	−0.055	−0.042	−0.029
p50	0.089	0.094	0.050	0.056	0.062	0.063	P50	0.070	0.069	0.036	0.037	0.038	0.040	P50	0.076	0.070	0.023	0.025	0.026	0.035
p75	0.171	0.173	0.119	0.127	0.135	0.141	P75	0.171	0.168	0.120	0.116	0.119	0.122	P75	0.164	0.163	0.099	0.098	0.104	0.115

Source: AJPES (2012); own calculations.

Note: In units of the balance sheet sum; "fixed" collateral (collateral assets do not include financial assets); cash flow from current business; quartiles of companies population are calculated for every variable (financial debt, receivables and operating liabilities, cash flow and collateral) separately; median values for every quartile are presented.

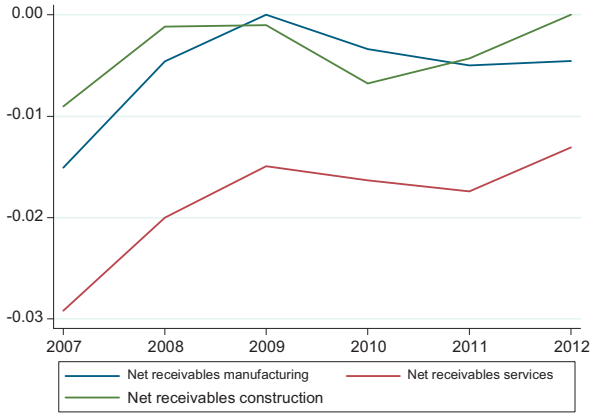

Fig. 4. Illiquidity per unit of balance sheet; sectors of companies (median).
Source: AJPES (2012); own calculations.

deterioration of cash flow caused by the crisis seriously endangered the solvency of companies in the first quartile of the services sector and construction sector, especially. In both cases, cash flow dropped to negative values in 2009 and remained negative even three years after the crisis eruption. In the manufacturing sector, cash flow of the companies from the first quartile also dropped in negative values in 2009, but recovered to positive values already in 2010.

To reveal the segments of companies that could face potential liquidity and/or solvency collapses in the continuation of the deleveraging process, Table 1 presents also a trajectory of financial debt, receivables, operating liabilities, and potential "fixed" collateral for the period 2007–2012.[19] The rapid growth of debt before the crisis leveled off in 2009 in all the presented segments of companies. However, the level of debt in the post-crisis period in the manufacturing sector for median companies has been much higher (50%) than in the services sector. At the same time, highly indebted companies (companies from the third quartile) have the same size of debt in both the manufacturing and services sectors. The indebtedness of firms in the construction sector increased up until the year 2010, but began to decrease in subsequent years. The construction sector seems to be the most intensive in the deleveraging process.

Available collateral of companies from the services and construction sectors is much lower than the collateral of the companies from the manufacturing sector. More than half of companies from the services and construction segments had no "fixed" collateral in the studied boom-bust period, 2006–2012. It seems the lack of collateral was probably the key factor generating obvious lags in the cash flow improvement of service-oriented and construction companies (see Table 1). Due to banks' practices of nearly complete collateralization of credit after the 2009 crisis, these companies had restricted access to loanable funds independent of the quality of their cash flow performance.

Short-term liabilities are bigger than short-term receivables for all quartiles of firms in the manufacturing sector in the whole period. Their shares in the balance sheet did not change substantially (see Table 1). However, they are lower in the manufacturing sector compared to the services sector, and, especially, compared to the construction sector.

[19] "Fixed" collateral includes land, buildings, and machinery owned by companies.

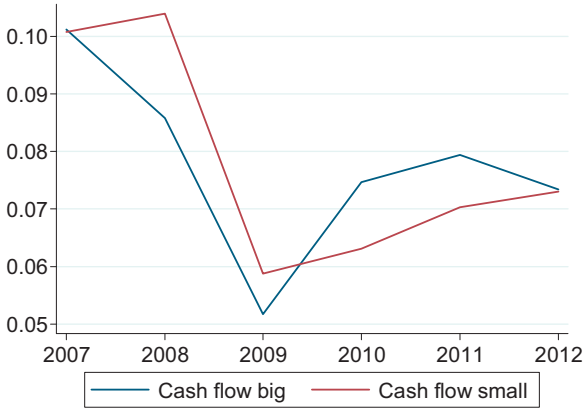

Fig. 5. Cash flow per unit of balance sheet; "big" and "small" companies in manufacturing (median).
Source: AJPES (2012); own calculations.

Net receivables (short-term receivables–short-term liabilities) are negative and near 0 for medium-sized firms in the manufacturing and construction sectors (see Fig. 4). They are higher than in the services sectors. This indicator of illiquidity has been increasing in all three sectors up until 2009 when it began to decline. After 2010, net receivables started to grow again.

We also provide size specificities of cash flow dynamics and illiquidity (Figs. 5–10). In the manufacturing sector (but not in the construction and services sectors), the drop in cash flow was higher in small enterprises; also an improvement after 2009 was slower. In services and construction companies, the cash flow trajectory did not differ between small and large companies. In addition, small firms are lagging behind large firms in the whole observed period in all three sectors in terms of illiquidity. However, the situation for small firms has been improving consistently after the crisis eruption.

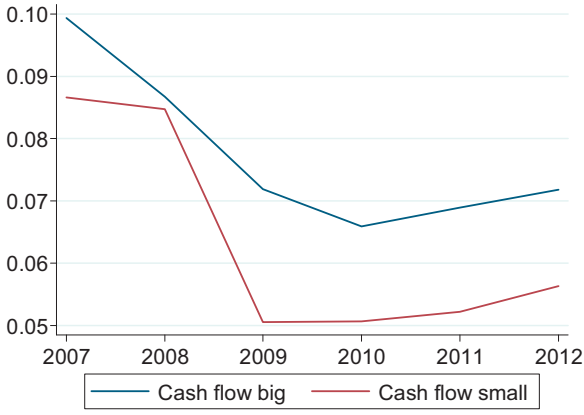

Fig. 6. Cash flow per unit of balance sheet; "big" and "small" companies in services (median).
Source: AJPES (2012); own calculations.

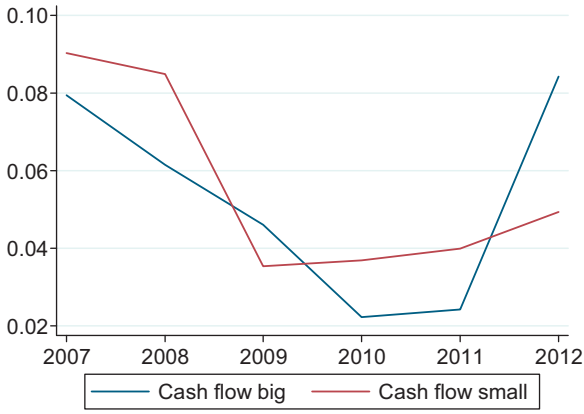

Fig. 7. Cash flow per unit of balance sheet; "big" and "small" companies in construction (median).
Source: AJPES (2012); own calculations.

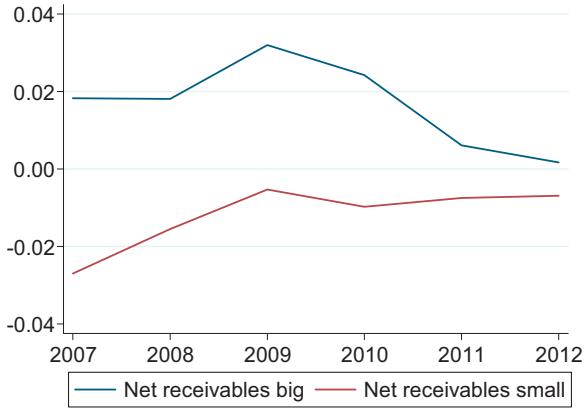

Fig. 8. Illiquidity per unit of balance sheet; "big" and "small" companies in manufacturing (median).
Source: AJPES (2012); own calculations.

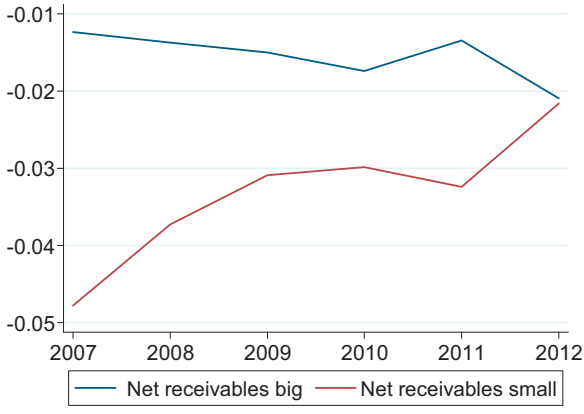

Fig. 9. Illiquidity per unit of balance sheet; "big" and "small" companies in services (median).
Source: AJPES (2012); own calculations.

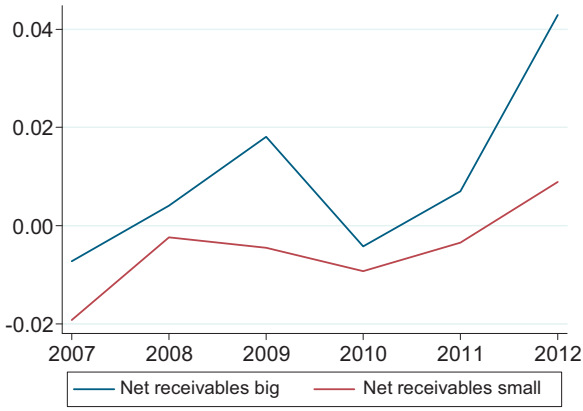

Fig. 10. Illiquidity per unit of balance sheet; "big" and "small" companies in construction (median).
Source: AJPES (2012); own calculations.

5. Cash flow migration mechanism

5.1. Cash flow migration matrix

To illustrate that improvement of economic performance is blocked at the very micro level (because insufficient credit support of banks, illustrated on Fig. 1 stifles the reproduction power of firms' ecosystems), Table 2 presents the cash flow migration matrix of firms for a one-year horizon for the 2007–2011 period. It shows how the cash flow of the total population of firms in (current) year T is structured in the following year T + 1. Three possible performance segments are observed in year T + 1: first, the segment of firms, which are inactive ("went bankrupt"), second, the segment of firms that have positive cash flow, and third, the segment of firms which have negative cash flow. That is, firms are structured according to the cash flow status in the following year (T + 1), but for each kind of the present (T) cash flow status separately.

From Table 2, it is obvious that the crisis drastically deteriorated the cash flow migration of firms. In 2009, for example, almost one quarter of enterprises, which had positive cash flow in 2008 (19% of all enterprises), ran a negative cash flow, and almost 4.2% went bankrupt.

Table 2
Conditional cash flow migration for a one-year horizon.

	Positive to positive	Positive to negative	Positive to bankruptcy	Negative to positive	Negative to negative	Negative to bankruptcy	Total number of companies
2007	64.97%	12.58%	3.42%	7.85%	9.23%	1.94%	48,781
2008	56.38%	19.01%	4.15%	7.04%	11.21%	2.23%	51,997
2009	53.05%	14.11%	3.70%	10.93%	15.07%	3.15%	53,897
2010	54.40%	13.80%	3.61%	10.55%	14.46%	3.19%	55,734
2011	55.36%	13.35%	4.05%	10.18%	13.91%	3.16%	57,798

Source: AJPES (2012); own calculations.
Note: Cash flow migration for a one-year horizon conditionally on the cash flow status in the current year; shares of companies of given cash flow status in the current year for which cash flow status would change as indicated.

Table 3
Sectoral cash flow migration for a one-year horizon.

	To positive	To negative	Bankrupt	Total number of companies
Manufacturing				
2007	78.96%	17.38%	3.66%	6771
2008	67.98%	27.99%	4.04%	6676
2009	70.67%	24.42%	4.91%	6726
2010	72.67%	22.27%	5.07%	6906
2011	73.37%	21.38%	5.25%	7033
Services				
2007	73.26%	22.06%	4.68%	33155
2008	64.94%	30.24%	4.81%	33962
2009	65.25%	29.37%	5.38%	35491
2010	65.72%	28.76%	5.52%	36769
2011	66.16%	28.25%	5.59%	38217
Construction				
2007	73.83%	19.72%	6.45%	6175
2008	57.57%	31.49%	10.94%	6746
2009	56.06%	32.26%	11.68%	6814
2010	57.05%	31.47%	11.48%	6803
2011	58.22%	28.41%	13.36%	6943

Source: AJPES (2012); own calculations.
Note: Cash flow migration for a one-year horizon; shares of companies in the current year for which cash flow status would change as indicated.

By calling firms with positive cash flow in year T, which migrate to negative cash flow in year T + 1 "collapsing" firms (second column in Table 2) and firms with negative cash flow in year T, which improve their performance to positive cash flow in T + 1 "recovering" firms (fourth column in Table 2), we can observe that the first wave of the performance migration deterioration (for a one-year horizon) already hit the economy in 2008; it is visible from the 2007 row in Table 2 that the percentage of recovering enterprises was smaller than the percentage of the collapsing enterprises. The difference was large already in 2007, but increased even more in 2008. In 2008, the increase in the percentage of collapsing firms attained 6.4 percentage points (in 2007 the number of collapsing firms was 12.6%, and in 2008 it was 19.0% of all firms, see Table 2) and the decrease in the percentage of recovering enterprises by 0.9 percentage points (in 2007 the number of recovering firms was 7.9% and in 2008 it was 7.0% of all enterprises) and additionally increase the difference between collapsing and recovering companies.

Both the percentage of recovering and collapsing firms has been decreasing slowly after the first year of the crisis. In 2011, 13.3% of all enterprises (around 7500 firms) still switched from positive (in 2010) to negative (in 2011) cash flows. But the difference between the percentage of collapsing and recovering firms almost stabilized. The new equilibrium in the firms' eco systems is achieved where the permanent share of firms with negative cash flow and bankruptcy rate are much higher than before the crisis. In the model based evidence it is documented that insufficient bank loan support to enterprises prevents the firms' eco systems to attain the pre-crisis equilibrium.

In looking for sector (manufacturing, services, or construction) specifities of firms, firms in Table 3 are structured according to cash flow status for a one-year horizon (T + 1). To avoid too big of a table, firms are structured unconditionally on the present (T) status of cash flows (as in

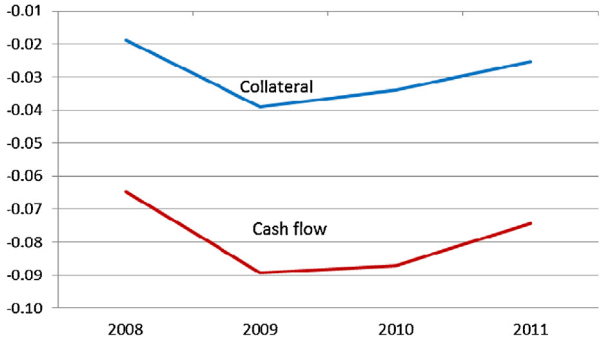

Fig. 11. Marginal effects on probability of bankruptcy a one-year horizon; collateral versus cash flow.
Source: AJPES (2012); own calculations.

Table 2).[20] The migration of firms to negative cash flow and bankruptcy is much bigger in the services and construction sector than in the manufacturing sector. The group of firms migrating to negative cash flows had been increased in 2008 in all sectors, but has been declining in subsequent years, with declines being the fastest in the manufacturing sector.

After the crisis, the segment of firms with negative cash flows increased to a new equilibrium level of over 27% of all enterprises.

5.2. *Model of cash flow migration*

We constructed a multinomial logit model of cash flow migration where the dependent variable shows the status of cash flow in the next year: 0: bankruptcy, 1: negative cash flow and 2: positive cash flow. As independent variables we used two financial variables: cash flow and financial debt. Following Miller and Stiglitz (2010) and Krishnamurthy (2010), these indicators mirror fairly well firm performance transition through the boom-bust episode driven by external factors and amplified by a financial accelerator.[21] Both variables are further structured by adding also short-term liabilities and short-term receivables variables, so intercompany credits as an alternative (non-banking) way of financing firms' working capital and potential (expected) cash flows are taken into account. Due to the crucial role of debt collaterization in accessing banking credit after the sudden stop (shown in the third chapter), the size of collateral is also added as the explanatory variable. Finally, following our discussion in the previous chapter, we include sectors and size dummies.

In estimating, multinomial logit regression is normalized on the negative cash flow status of the dependent variable (ind_cf = 1). The results of multinomial logit regressions are presented for each year of the observed period 2007–2012 in Table 4. Marginal effects of each explanatory variable on the estimated probability of cash flow status for a one-year horizon are also given. In Figs. 11–16, marginal effects, crucial to the discussion, are illustrated; a pairwise comparison (collateral vs. cash flow and financial debt vs. intercompany debt) of marginal effects on probability of bankruptcy, negative cash flow, and positive cash flow for a one-year horizon are given.

[20] Conditional structure of cash flow migration is available from the authors upon request.

[21] As an indicator of financial health, they are used in similar research. Charitou, Neophytou and Charlambous (2004), for example, found that in the UK a cash flow variable, financial leverage variable, and profitability yielded an overall correct classification accuracy of 83% of failures one year prior to the failure.

Table 4
Model of cash flow migration.

	0 Coefficient	2 Coefficient	0 Marginal effects	1 Marginal effects	2 Marginal effects
ind_cf 2007					
Collateral	−0.077	0.703*	−0.019***	−0.091***	0.110***
Cash flow	−0.137	2.552*	−0.065***	−0.332***	0.397***
Financial debt	−0.939***	−0.946*	−0.004	0.128***	−0.124***
Buyers	0.465***	0.130*	0.010***	−0.019***	0.009
Suppliers	−0.055	−0.890**	0.020***	0.116***	−0.136***
dum_services	0.190***	−0.087**	0.007***	0.010**	−0.017***
dum_construction	−13.804***	−0.347	−0.029***	0.059	−0.029
dum_empl0	0.447*	−0.562	0.039**	0.080***	−0.119***
dum_empl25	−0.310	−0.132	−0.006	0.018	−0.012
dum_empl50	0.205	0.208	0.001	−0.026*	0.025
dum_empl100	−0.166	0.044	−0.005	−0.005	0.010
_cons	−1.615***	1.940			
Observations	37748				
ind_cf 2008					
Collateral	−0.694***	0.690***	−0.039***	−0.122***	0.161***
Cash flow	−0.701***	2.804***	−0.089***	−0.516***	0.606***
Financial debt	−0.664***	−0.185***	−0.017***	0.040***	−0.023**
Buyers	0.183**	−0.046	0.007***	0.007	−0.014
Suppliers	−0.010	−0.375***	0.009***	0.070***	−0.079***
dum_services	0.027	0.099***	−0.001	−0.019***	0.021***
dum_construction	0.895***	−0.129***	0.052***	0.010	−0.062***
dum_empl0	0.152	−0.669***	0.025**	0.135***	−0.160***
dum_empl25	−0.346	−0.167**	−0.008	0.033**	−0.025
dum_empl50	−0.023	0.082	−0.003	−0.015	0.017
dum_empl100	0.171	−0.063	0.008	0.010	−0.018
_cons	−1.679***	0.952***			
Observations	38540				
ind_cf 2009					
Collateral	−0.558***	0.619***	−0.034***	−0.102***	−0.136***
Cash flow	−0.409***	2.948***	−0.087***	−0.507***	0.594***
Financial debt	−0.529***	−0.507***	−0.005	0.092***	−0.087***
Buyers	0.049	−0.027	0.002	0.004	−0.007
Suppliers	0.128***	−0.624***	0.020***	0.107***	−0.127***
dum_services	−0.133	−0.113***	−0.002	0.020***	−0.018***
dum_construction	0.606***	−0.335***	0.042***	0.052***	−0.094***
dum_empl0	0.449*	−0.538***	0.041**	0.094***	−0.135***
dum_empl25	−0.127	−0.063	−0.003	0.012	−0.009
dum_empl50	−0.397	0.081	−0.012*	−0.011	0.024
dum_empl100	0.053	0.102	−0.001	−0.018	0.018
_cons	−1.661***	1.405***			
Observations	40189				
ind_cf 2010					
Collateral	−0.266**	0.623***	−0.021***	−0.104***	0.125***
Cash flow	−0.415***	2.633***	−0.069***	−0.443***	0.513***
Financial debt	−0.278***	−0.567***	0.004	0.098***	−0.102***
Buyers	0.248**	0.040	0.006**	−0.009	0.002
Suppliers	0.155***	−0.666***	0.019***	0.112***	−0.131***

Table 4 (*Continued*)

	0 Coefficient	2 Coefficient	0 Marginal effects	1 Marginal effects	2 Marginal effects
dum_services	−0.191***	−0.182***	−0.001	0.030***	−0.029***
dum_construction	0.497***	−0.387***	0.032***	0.064***	−0.097***
dum_empl0	−0.073	−0.655***	0.013	0.128***	−0.141***
dum_empl25	−0.765***	−0.159	−0.025**	0.032*	−0.007
dum_empl50	−0.319	0.068	−0.009*	−0.010	0.019
dum_empl100	−0.106	−0.153	0.000	0.028	−0.028
_cons	−1.166***	1.637***			
Observations	41070				
ind_cf 2011					
Collateral	−0.329***	0.639***	−0.025***	−0.103***	0.129***
Cash_flow	−0.238**	2.833***	−0.074***	−0.466***	0.541***
Financial debt	−0.416***	−0.726***	0.004	0.123***	−0.127***
Buyers	0.210***	−0.017	0.007***	0.001	−0.008
Suppliers	0.066***	−0.641***	0.017***	0.106***	−0.123***
dum_services	−0.312***	−0.207***	−0.005**	0.034***	−0.029***
dum_construction	0.649***	−0.321***	0.042***	0.047***	−0.089***
dum_empl0	0.159	−0.585***	0.023*	0.107***	−0.130***
dum_empl25	−0.509**	−0.189*	−0.013	0.033**	−0.020
dum_empl50	−0.217	−0.009	−0.006	0.003	0.003
dum_empl100	−0.280	−0.074	−0.006	0.014	−0.008
_cons	−1.149***	1.731***			
Observations	42282				

Source: AJPES (2012); own calculations.

Note: Dependent variable ind_cf is cash flow status for a one-year horizon; status of cash flow: 0 bankruptcy, 1 – negative cash flow, 2 – positive cash flow; dum_services, dum_construction are indicator variables for services sectors and construction; dum_empl are indicator variables for the size groups of companies; variable *y* used in calculating marginal effects is model estimation of probability of cash flow status for a one-year horizon (T + 1) at median values of independent variables (*x*) in T; for dummy variables *dx* is discrete change of dummy variable from 0 to 1; all continuous variables are in units of balance sheet.

* Statistical significance at 10%.

** Statistical significance at 5%.

*** Statistical significance at 1%.

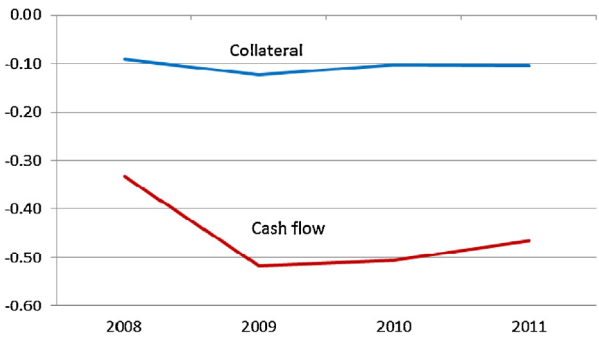

Fig. 12. Marginal effects on probability of negative for cash flow for a one-year horizon; collateral versus cash flow.
Source: AJPES (2012); own calculations.

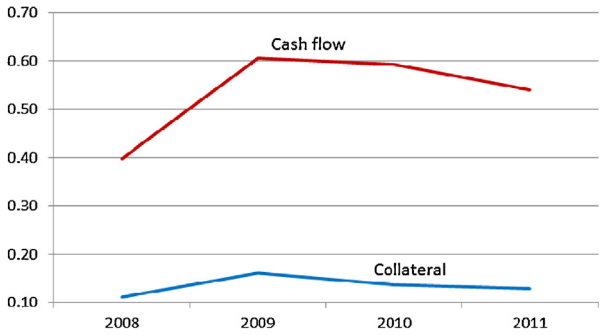

Fig. 13. Marginal effects on probability of positive cash flow for a one-year horizon; collateral versus cash flow.
Source: AJPES (2012); own calculations.

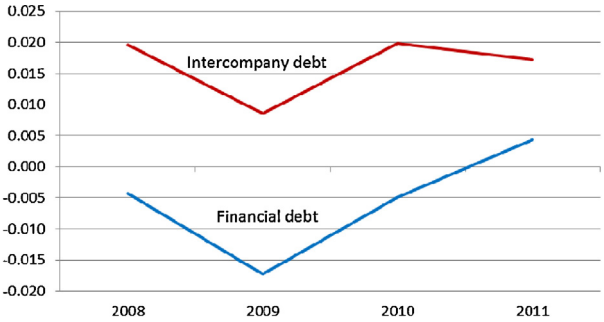

Fig. 14. Marginal effects on probability of bankruptcy for a one-year horizon; financial versus intercompany debt.
Source: AJPES (2012); own calculations.

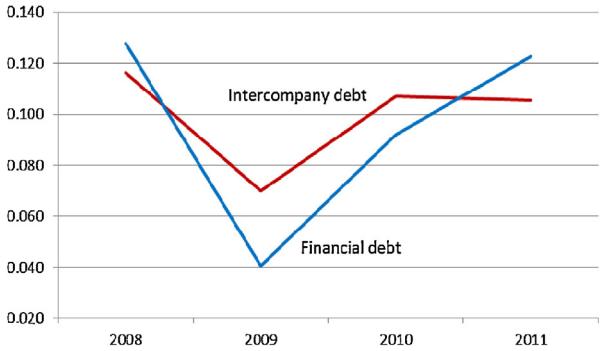

Fig. 15. Marginal effects on probability of negative cash flow for a one-year horizon financial versus intercompany debt.
Source: AJPES (2012); own calculations.

Figs. 11–16 reveal several important observations:

- The level of cash flow in the current period has an undoubtedly higher marginal effect on the future status of firms (bankruptcy, negative cash flow, and positive cash flow) than the level of collateral (Figs. 11–13). This means that in the process of deleveraging, banks should pay more

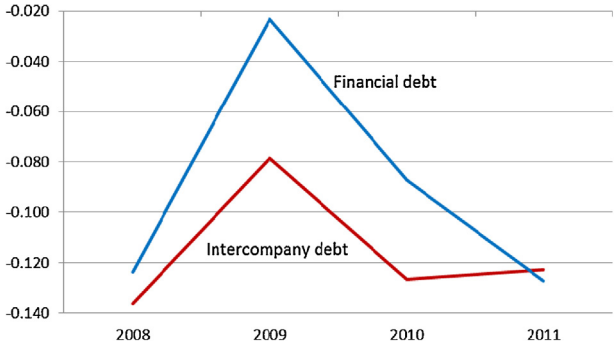

Fig. 16. Marginal effects on probability of positive cash flow for a one-year horizon; financial versus intercompany debt. *Source*: AJPES (2012); own calculations.

attention to cash flow than to collateral at providing liquidity, especially to healthier firms with positive cash flow.

- Collateral is important (if compared with cash flow) for bankruptcy endangered firms.
- The marginal effect of cash flow and collateral increased remarkably in the first year of the crisis (2009) and the year later (2010). Both increase the probability of positive cash flow in the next year and decrease the probability of migration to negative cash flow or bankruptcy status. This shows the importance of liquidity support immediately after the crisis eruption, that is, the importance of timing the measures supporting liquidity.
- The sizes of marginal effects of financial debt and intercompany debt (Figs. 14–16) are almost the same in the whole observed period, except in the first year of the crisis (2009), when marginal effects are much higher, respectively by over 50% and over 130% (in distant years even several times) higher. For companies migrating to positive cash flow status in year T + 1, marginal effects of both variables are negative (less financial indebtedness and less intercompany credit imply higher probability of positive cash flow in the next year), for companies migrating to negative cash flow status, both variables have a positive marginal effect (more financial debt and more intercompany credit imply higher probability of having negative cash flow in the next year), while the marginal effect on the probability of migrating to bankruptcy is positive for intercompany debt and negative for financial debt. Increasing financial (but not intercompany!) credits could, therefore, curb migration to bankruptcy status.
- The relative importance of the marginal effect of intercompany debt compared to financial debt increased in 2009 and 2010, which points to the appropriate sequencing of policy measures. Namely, policy measures would first have to support decreasing (deleveraging) intercompany debt (effects of crisis), and afterwards support deleveraging financial debt. Providing more liquidity (credit) to firms with positive cash flow would decrease intercompany debt and allow easier (more sustainable) deleveraging of financial debt in the later period.

There are additional results that could be subtracted from our data. As observed in Table 4, marginal effects of the services and construction sectors on the probability of joining the group with positive cash flow in T + 1 period are mainly negative (except for services in 2008), thus showing that companies in these two sectors have a lower probability of generating positive cash flow than firms in the manufacturing sector. On the other hand, marginal effects of both sectors on the probability of firms joining a group with negative cash flow in T + 1 period are expectedly

positive (the exception is services in 2008). For the bankruptcy group, marginal effects of the services sector are negative most of the time (except in 2007), but positive for the construction sector (again, except in 2007). A severe cut in domestic demand (versus quite sustainable export growth) in the period after 2009 was probably the main reason for such sectoral effects.

Finally, the size of employees does not have a major influence on the probability of joining any group in period T + 1. The exemptions are firms with a small number of employees. In all years, the smallest segment of firms (with no employee) had a higher probability to migrate to negative cash flow or bankruptcy status than larger segments. The marginal effects of this variable in the next period are, namely, systematically positive for the bankrupt group and for the group with negative cash flow, and negative for the group with positive cash flow.

6. The illiquidity contagion mechanism

As discussed in the previous chapter, smaller firms in Slovenia and firms in the services and construction sectors are more likely to be a liquidity constraint in the post-crisis period. In addition, in the above sectors intercompany debt is more important for firm migration to negative cash flow or bankruptcy status in the period T + 1. Since the crisis eruption, demand for services and construction has not yet normalized, but strong external demand has prevailed for almost three years in the manufacturing sector. It could be expected, therefore, that companies from the services and construction sectors use forced credit more frequently and are probably originators of forced credit, more than manufacturing companies.

Identifying the channels through which economic policy could eventually influence the spread of illiquidity is the key question of policy makers about the transmission mechanism of intercompany indebtedness and illiquidity. To reveal the mentioned structural effects, we constructed the model of illiquidity contagion. In addition we also test the predictions of the Miller and Stiglitz (2010) theoretical model on a stepwise path after switching from boom to bust, first to illiquidity and then insolvency when collateralized borrowing is the prevailing way of financing and firms are disturbed by the external shocks. As stated by Miller and Stiglitz (2010), "as asset prices fall and balance sheets are marked-to-market, small businesses will be loaded up with debt without the anticipated flow received to service it. . . . The ending of the bubble will clearly pose a liquidity problem and may threaten insolvency" (p. 508).

Undoubtedly, contagion is smaller when the difference between short-term operating receivables and liabilities is smaller, but in absolute, not nominal terms. Therefore, a dependent variable in the model is defined as an increment in absolute value of net receivables. Independent variables are increments in financial debt and cash flow, both measured per unit of the balance sheet sum. Dummy variables for different industries (manufacturing, services and construction) and different sizes of firms (firms with 0, 1–25, 26–50, 51–100 and 101) are added to measure a structural change; firms in manufacturing and firms with over 100 employees are serving as a base.

The model is estimated for the 2008–2012 period and for each year separately. Due to quickly changing regimes (from boom to crisis and from crisis to recovery), yearly regression estimates have to be made to enable the comparison of regime specific effects of cash flow and financial debt on illiquidity contagion. We use instruments to control the possible endogeneity of the explanatory variables. Instruments are current and lagged fixed collateral, as well as current and lagged number of employees.

The results are presented in Table 5. The models confirm that to prevent illiquidity from spreading among companies, both effects, the increase in credits and current cash flow, are effective. Speaking about timing and calibration of policy interventions in steering the deleveraging process,

Table 5
Model of companies' illiquidity contagion.

Narrow nwc	2008	2009	2010	2011	2012
Financial debt	−0.549*** (0.048)	−0.675*** (0.071)	−0.561*** (0.066)	−0.533*** (0.062)	−0.509*** (0.065)
Cash flow	−0.273*** (0.087)	−0.365*** (0.060)	−0.349*** (0.063)	−0.343*** (0.078)	−0.543*** (0.097)
dum_services	−0.004 (0.003)	−0.001 (0.003)	−0.009*** (0.003)	−0.004 (0.003)	−0.007* (0.004)
dum_construction	−0.005 (0.004)	0.011** (0.004)	−0.007 (0.005)	−0.008 (0.005)	−0.013** (0.005)
dum_empl0	−0.025*** (0.009)	−0.009 (0.008)	−0.015* (0.008)	−0.005 (0.009)	−0.019* (0.010)
dum_empl25	−0.007 (0.007)	0.011 (0.008)	−0.000 (0.007)	0.007 (0.008)	−0.003 (0.009)
dum_empl50	−0.010 (0.009)	0.013 (0.009)	−0.004 (0.009)	0.002 (0.009)	0.004 (0.010)
dum_empl100	0.002 (0.010)	0.009 (0.011)	−0.014 (0.011)	−0.003 (0.011)	0.009 (0.012)
Constant	0.055*** (0.011)	0.025*** (0.008)	0.039*** (0.009)	0.026*** (0.010)	0.051*** (0.012)
Observations	35077	36937	38481	39445	40571
Craig-Donald Wald F statistic	16.779	35.637	29.482	19.605	14.355
Stock-Yogo weak ID test critical values					
Max. IV relative bias	5% (13.97)	5% (13.97)	5% (13.97)	5% (13.97)	5% (13.97)
Max. IV size	15% (11.22)	10% (19.45)	10% (19.45)	10% (19.45)	15% (11.22)
Andereson canon					
Corr. LM statistic	83.725	177.565	146.894	97.813	71.668
Chi-sq(3)	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan statistic	0.709	1.217	0.555	0.489	1.576
Chi-sq(3)	0.8711	0.7490	0.9067	0.9213	0.6648

Source: AJPES (2012); own calculations.
Note: Standard errors in parentheses; Dependent variable is increment in absolute value of net current receivables; all continuous variables are in units of balance sheet; 2SLS is used in estimation; current and lagged collateral and number of employed are used as instruments.
* Statistical significance at 10%.
** Statistical significance at 5%.
*** Statistical significance at 1%.

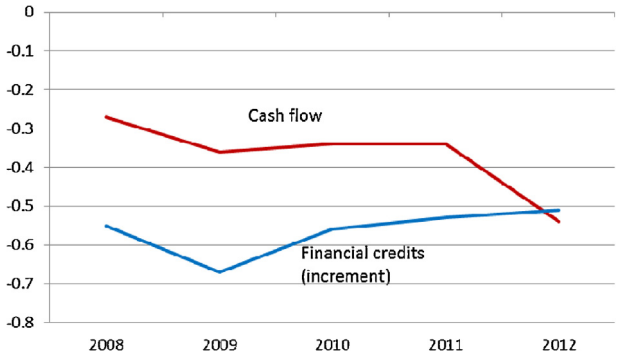

Fig. 17. Marginal effects of cash flow and increment in financial debt on intercompany indebtedness.
Source: AJPES (2012); own calculations.

it is worthwhile to stress the credits effect. Namely, credits significantly contribute to curbing illiquidity transmission; the effect is especially strong in the year of crisis eruption (2009), that is in the year when sudden stop strike (Fig. 17). After 2009 the effects of financial credits have been tapering off. In the same time, the trajectory of cash flow effects does not demonstrate any visible tapering off after the crisis eruption. So differences in marginal effects of credits and cash flow were over 40% higher in 2009 than in the following years.

Even more by using evidence presented in Fig. 17, we could find that the effects of cash flow increase over the long run, while the effects of financial credits are especially important in the short run, after the crisis eruption. The appropriate policy measures in 2009 and 2010 would therefore have to stimulate the provision of additional liquidity to companies (if they already have positive cash flow) and not push them in deleveraging. Because actual policy response did not follow the mentioned guidelines for timing and sequencing of measures, forced credits and illiquidity spreads from the most affected companies – sectors (sectors without collateral) to the whole economy.

Such mechanism of contagion spreading is also confirmed by the size and sign of the coefficients on sectoral dummy variables for the services and construction sectors. Except for the construction sector in 2009, sectoral effects for all other years (for the construction and services sectors) are negative or insignificantly positive. The above results are additional support for the results already presented in the previous chapter, where we have shown that intercompany debt was an important factor behind the migration of companies to negative cash flow and bankruptcy status.

The dummy variables, representing different sizes of companies, are in most cases insignificant.

7. Conclusion

Empirical results in the paper show that the wrong timing, sequencing and calibration of deleveraging in Slovenia had high opportunity costs in the boom-bust episode (2007–2012). Procyclical interventions of the banking regulator and corresponding responses of banks resulted in a prolonged (after crisis) credit crunch period and spiraling financial de-intermediation. Cutting bank (financial) credits independently of company performance (e.g. cash flow dynamics) in the first years after the crisis eruption greatly increased the migration of firms to negative cash flow and bankrupt status in the following years. In addition, companies increased the level of forced

(intercompany) credits, especially in service in the construction sector (due to a low level of collateral), which spread illiquidity to the whole economy.

Based on our research, we claim that taming deleveraging after the crisis eruption in the first year would decrease intercompany illiquidity (in comparison with cash flow by over 40%) more efficiently than in the following years. At the same time, the (negative) marginal effect of rolling over debt on the probability of firm cash flow migration would be considerably lower (at least 50% for intercompany debt and several times lower for financial debt) than in the more distant years. Even more beneficial would be marginal effects of taming first year deleveraging on the probability of bankruptcy status (namely rolling over financial debt and even decreasing the probability of bankruptcy status). The same results also give the deleveraging process calibration guidelines, that is, they show how much relative intensity of the optimal deleveraging process would have to be decreased (in comparison with more distant or pre crisis years) in the first two years after the crisis eruption (three times more for financial debt and 40% for intercompany debt). And finally, our results determine the optimal sequencing of debt redemption (deleveraging). As an alternative approach to cutting banking credits immediately after sudden stop (independently of intercompany debt and cash flow), banks would have to first revolve credits to firms. In doing so, intercompany credits would be reduced in companies that have "appropriate performances", e.g. positive cash flow (banks could even take additional steps to help restructure weaker companies). Banking credits would have to be reduced afterwards.

The main lesson from this disastrous policy response in the after crisis period in Slovenia is that appropriate timing, sequencing, and calibrating have to be an integral part of the optimal deleveraging process policy design. This demands that the Central Bank not only look at its traditional goals (i.e. price stability and micro prudential stance of the banking sector), but also focus on the stability of the financial system. That is especially pronounced in emerging markets, which are more prone to swings and cycles in the financial system. This task should be a constitutional part of the third macro policy pillar, namely macroprudential policy.[22]

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[22] The example of the U.K. might show the way by having a monetary stability and financial stability committtee, both within the Bank of England (Blanchard, Dell'Ariccia, & Mauro, 2013).

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